IN THE CLAIMS

1. (Original) A method for removing heavy metals or radionuclides from an aqueous and/or gaseous solution comprising contacting said aqueous solution and/or gaseous solution an ion exchange material selected from a solid ion exchange material, a liquid ion exchange material, or mixtures thereof, wherein said ion exchange material is prepared by the process comprising:

(a) contacting clinoptilolite with an alkaline solution at a temperature of about 85°C to about 300°C and for a sufficient time to form a treated slurry comprising a solid fraction and a liquid fraction, and optionally

(b) separating the solid fraction from said treated slurry and washing the solid fraction to produce said solid ion exchange material; and

(c) recovering the liquid fraction of said treated slurry from step (b) to produce said liquid ion exchange material;

wherein when a solid ion exchange material is used, said solid ion exchange material is the solid ion exchange material of step (b); when a liquid ion exchange material is used, said liquid ion exchange material is the liquid ion exchange material of step (c); and when a mixture of said solid ion exchange material and said liquid ion exchange material is used, said mixture can be said treated slurry produced in step (a) or said mixture can be prepared by mixing said solid ion exchange material of step (b) with said liquid ion exchange material of step (c).

2. (Original) The method of claim 1 wherein said ion exchange material is said solid ion exchange material.

3. (Original) The method of claim 2 wherein an aqueous and/or gaseous solution containing heavy metals or radionuclides is passed through a bed or column containing said solid ion exchange material.

4. (Original) The method of claim 2 wherein an aqueous and/or gaseous solution containing heavy metals or radionuclides is processed batchwise by charging said solid ion exchange material into a volume of contaminated aqueous or gaseous solution, agitating for a sufficient period of time, and conducting a liquid/solid separation or gas/solid separation to remove solids.

5. (Original) The method of claim 1 wherein said ion exchange material is said liquid ion exchange material.

6. (Original) The method of claim 5 wherein said aqueous or gaseous solution is acidic.

7. (Original) The method of claim 6 wherein said liquid ion exchange material is contacted with an aqueous or gaseous solution containing heavy metals and radionuclides for a sufficient period of time to precipitate contaminants from solution, and conducting a liquid/solid separation or gas/solid separation to remove the precipitated contaminants from the solution.

8. (Original) The method of claim 7 wherein the amount of said liquid ion exchange material contacted with said aqueous or gaseous solution is sufficient to produce an aqueous or gaseous solution having a pH after contacting with said liquid ion exchange material and removing said precipitated contaminants of about 6 to about 9.

9. (Original) The method of claim 1 wherein said ion exchange material is a mixture of said solid ion exchange material and said liquid ion exchange material.

10. (Original) The method of claim 1 wherein step (a) is conducted under a pressure greater than the ambient pressure.

11. (Original) The method of claim 1 wherein the alkaline solution used in step (a) has a concentration greater than about 0.5 M.

12. (Original) The method of claim 1 wherein step (a) is conducted at a temperature of about 100°C to about 125°C.

13. (Original) The method of claim 1 wherein the ratio of clinoptilolite to alkaline solution in the slurry in step (a) is about 5 to about 50 grams clinoptilolite per 100 mL of alkaline solution.

14. (Original) The method of claim 1 wherein the alkaline compound in said alkaline solution is selected from alkali metal hydroxides, alkaline earth metal hydroxides, ammonium hydroxide, tetraalkylammonium hydroxides, or mixtures thereof.

15. (Original) The method of claim 14 wherein said alkaline compound is an alkali metal hydroxide.

16. (Original) The method of claim 15 wherein said alkali metal hydroxide is sodium hydroxide or potassium hydroxide.

17. (Original) The method of claim 1 wherein the contacting time of step (a) is about 30 minutes to about 4 hours.

18. (Original) A process for producing an ion exchange material useful for removing heavy metals or radionuclides from an aqueous or gaseous solution comprising:

(a) contacting clinoptilolite with an alkaline solution at a temperature of about 85°C to about 300°C and for a sufficient time to form a treated slurry comprising said ion exchange material comprising a solid fraction and a liquid fraction.

19. (Original) The process of claim 18 further comprising:

(b) separating the solid fraction from said treated slurry and washing the solid fraction to produce a solid ion exchange material; and

(c) recovering the liquid fraction of said treated slurry from step (b) to produce a liquid ion exchange material;

20. (Original) The process of claim 19 wherein a mixture of said solid ion exchange material and said liquid ion exchange material is prepared by mixing said solid ion exchange material of step (b) with said liquid ion exchange material of step (c).

21. (Original) The process of claim 20 wherein said solid ion exchange material of step (b) is dried to produce a dried solid ion exchange material.

22. (Original) The process of claim 18 wherein step (a) is conducted under a pressure greater than the ambient pressure.

23. (Original) The process of claim 18 wherein the alkaline solution used in step (a) has a concentration greater than about 0.5 M.

24. (Original) The process of claim 18 wherein step (a) is conducted at a temperature of about 100°C to about 125°C.

25. (Original) The process of claim 18 wherein the ratio of clinoptilolite to alkaline solution in the slurry in step (a) is about 5 to about 50 grams clinoptilolite per 100 ml of alkaline solution.

26. (Original) The process of claim 18 wherein the alkaline compound in said alkaline solution is selected from alkali metal hydroxides, alkaline earth metal hydroxides, ammonium hydroxide, tetraalkylammonium hydroxides, or mixtures thereof.

27. (Original) The process of claim 26 wherein said alkaline compound is an alkali metal hydroxide.

28. (Original) The process of claim 27 wherein said alkali metal hydroxide is sodium hydroxide or potassium hydroxide.

29. (Original) The process of claim 18 wherein the contacting time of step (a) is about 30 minutes to about 4 hours.

30. (Original) A solid ion exchange material for removing heavy metals or radionuclides from an aqueous or gaseous solution, said solid ion exchange material being produced by the process comprising:

(a) contacting clinoptilolite with an alkaline solution at a temperature of about 85°C to about 300°C and for a sufficient time to form a treated slurry comprising a solid fraction and a liquid fraction,

(b) separating the solid fraction from said treated slurry and washing the solid fraction to produce said solid ion exchange material.

31. (Original) The composition of claim 30 wherein step (a) is conducted under a pressure greater than the ambient pressure.

32. (Original) The composition of claim 30 wherein the alkaline solution used in step (a) has a concentration greater than about 0.5 M.

33. (Original) The composition of claim 30 wherein step (a) is conducted at a temperature of about 100°C to about 125°C.

34. (Original) The composition of claim 30 wherein the ratio of clinoptilolite to alkaline solution in the slurry in step (a) is about 5 to about 50 grams clinoptilolite per 100 ml of alkaline solution.

35. (Original) The composition of claim 30 wherein the alkaline compound in said alkaline solution is selected from alkali metal hydroxides, alkaline earth metal hydroxides, ammonium hydroxide, tetraalkylammonium hydroxides, or mixtures thereof.

36. (Original) The composition of claim 35 wherein said alkaline compound is an alkali metal hydroxide.

37. (Original) The composition of claim 36 wherein said alkali metal hydroxide is sodium hydroxide or potassium hydroxide.

38. (Original) The composition of claim 30 wherein the contacting time of step (a) is about 30 minutes to about 4 hours.

39. (Original) A liquid ion exchange material for removing heavy metals or radionuclides from an aqueous or gaseous solution, said liquid ion-exchange material being produced by the process comprising:

(a) contacting clinoptilolite with an alkaline solution at a temperature of about 85°C to about 300°C and for a sufficient time to form a treated slurry comprising a solid fraction and a liquid fraction; and

(b) separating said liquid fraction from said treated slurry to produce said liquid ion exchange material.

40. (Original) The composition of claim 39 wherein step (a) is conducted under a pressure greater than the ambient pressure.

41. (Original) The composition of claim 39 wherein the alkaline solution used in step (a) has a concentration greater than about 0.5 M.

42. (Original) The composition of claim 39 wherein step (a) is conducted at a temperature of about 100°C to about 125°C.

43. (Original) The composition of claim 39 wherein the ratio of clinoptilolite to alkaline solution in the slurry in step (a) is about 5 to about 50 grams clinoptilolite per 100 ml of alkaline solution.

44. (Original) The composition of claim 39 wherein the alkaline compound in said alkaline solution is selected from alkali metal hydroxides, alkaline earth metal hydroxides, ammonium hydroxide, tetraalkylammonium hydroxides, or mixtures thereof.

45. (Original) The composition of claim 44 wherein said alkaline compound is an alkali metal hydroxide.

46. (Original) The composition of claim 45 wherein said alkali metal hydroxide is sodium hydroxide or potassium hydroxide.

47. (Original) The composition of claim 39 wherein the contacting time of step (a) is about 30 minutes to about 4 hours.

48-60 (Cancelled)